FACULTY OF APPLIED SCIENCES
BACHELOR OF SCIENCE IN COMPUTING
LEARNING MODULE OUTLINE

Academic Year	2023/2024	Semester	1
Module Code	COMP407		
Learning Module	Selected Topics 2: Machine Learning Application Development		
Pre-requisite(s)	Nil		
Medium of Instruction	English		
Credits	3	Contact Hours	45 hrs
Instructor	Tao Tan	Email	taotan@mpu.edu.mo
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MODULE DESCRIPTION

Machine Learning is one the hottest research and development area in Artificial Intelligence. Machine Learning has been successfully used in areas like Prediction, Image Classification, Computer Vision, Machin Translation etc. This module aims to develop students' abilities to apply Machine Learning algorithms to real-world Machine Learning and Computer Vision applications. Instead of teaching intensive mathematical foundations, concepts and algorithms, this Module will focus on helping students with developing different Machine Learning applications through mixture of lectures and lab practices. During the study, students will develop small machine learning projects like house price prediction, image classification, computer vision and a final Machine Learning project with report and presentation. This module will also help students for their Final Year Project development.

MODULE INTENDED LEARNING OUTCOMES (ILOS)

On completion of this learning module, students will be able to:

M1.	Understand the basic theoretical underpinning, the complexity and the limitations of machine learning algorithms. (SM1fl, SM2fl)
M2.	Demonstrate their knowledge of Machine Learning to implement practical applications; (EA1p, D5p)
M3.	Examine multiple criteria for analyzing Different Learning algorithms, and evaluate algorithms on these metrics: e.g. empirical performance, convergence, etc. (EA1fl)
M4.	Write formal project documents and conduct demonstration. (EP4p, D2p, D6p)

These ILOs aims to enable students to attain the following Programme Intended Learning Outcomes (PILOs):

PILOs		M1	M2	M3	M4
P1.	Select and apply proven methods, tools and techniques to the effective and efficient implementation of information systems;	✓			
P2.	Evaluate computer systems in a local area network, and understand the additional requirements for connection to other networks through wide area networks;		✓		
P3.	Be competent in system development in the Internet and the web platform;			✓	
P4.	Work independently to design and implement a relational database, with an emphasis on how to organise, maintain and retrieve information from a DBMS;	✓			✓
P5.	Acquire essential knowledge in specific fields of computing disciplines including multimedia, security and artificial intelligence;	✓			
P6.	Acquire the perceptive skills needed to understand information presented in the form of UML diagram, flow chart or other industry standard formats;				
P7.	Understand the need for and use of the necessary mathematical techniques;	✓	✓		✓
P8.	Work independently to develop an understanding of, and the knowledge and skills associated with the general support of computer systems and networks;		✓		✓
P9.	Work as an effective member of a team in the analysis, design and development of software systems;				✓
P10.	Use project planning and management techniques in systems development;				
P11.	Understand the fundamental and operational issues of computer systems in business environments;				
P12.	Equip with adequate written, oral communication and interpersonal skills;			✓	✓
P13.	Build the capacity and desire for lifelong learning and to learn advanced and emerging technologies on one's own;				
P14.	(For Enterprise Information Systems specialisation) Gain an in-depth understanding of the information technology related to enterprise information systems, with an emphasis on development of such systems to support business processes;				
P15.	(For Gaming Technology specialisation) Acquire the general and advanced knowledge of current technologies and operating environment in the gaming industry;				
P16.	(For Computer Education specialization) Acquire the general and practical knowledge of computer education and its practicing environment in secondary education.				

MODULE SCHEDULE, COVERAGE AND STUDY LOAD

Week	Content Coverage	Contact Hours
1-2	1. Introduction to Machine Learning	6
	1.1 ML applications	
	1.2 What constitutes an ML algorithm?	
	1.3 Supervised learning & unsupervised learning	
3-4	2. Linear regression and logistic regression	6
	2.1 Linear regression with one variable	
	2.2 Linear regression with multiple variables	
	2.3 Case study: predict house price using linear regression.	
	2.4 Classification	
	2.5 Logistic regression	
	2.6 Advanced optimization	
5-10	3. Deep Neural network	18
	3.1 What are neural networks?	
	3.2 Activation functions and error functions	
	3.3 Back propagation networks	
	3.4 CNN	
	3.5 Training deep models	
	3.6 Special training. Techniques	
	3.7 Case study: Hand writing digits recognition	
	3.8 Case study: Image Classification	
	3.9 Recurrent neural networks 6	
	3.10 LSTM 6	
	3.11 Case study: using LSTM to predict the stocks prices	
11-15	4. Computer Vision	15
	4.1 Basic Image Manipulation	
	4.2 Object Tracking	
	4.3 Case study: Face Detection using OpenCV	

	4.4 Object Detection	
	4.5 Introduction to YoLo	
	4.6 Detection Using A Pre-Trained Model	
	4.7 Changing parameters	
	4.8 Real-time detection on a Webcam	
	4.9 Training your own data with YoLo	

TEACHING AND LEARNING ACTIVITIES

In this learning module, students will work towards attaining the ILOs through the following teaching and learning activities:

Teaching and Learning Activities	M1	M2	M3	M4
T1. Lectures	✓			
T2. Case studies		✓	✓	✓
T3. In-class practice		✓	✓	✓

ATTENDANCE

Attendance requirements are governed by the Academic Regulations Governing Bachelor's Degree Programmes of the Macao Polytechnic University. Students who do not meet the attendance requirements for the learning module shall be awarded an 'F' grade.

ASSESSMENT

In this learning module, students are required to complete the following assessment activities:

Assessment Activities	Weighting (%)	AHEP3 LOs	ILOs to be Assessed
Assignments	20%	SM1fl, SM2fl，EA1p, D5p，EA1fl，EP4p, D2p, D6p	M1 M2 M3 M4
Test	30%	SM1fl, SM2fl，EA1p, D5p，EA1fl，EP4p	M1 M2 M3
Project	10%	EA1fl，EP4p, D2p, D6p	M3 M4
Exam	40%	SM1fl, SM2fl，EA1p, D5p，EA1fl，EP4p	M1 M2 M3

The assessment will be conducted following the University's Assessment Strategy (see www.mpu.edu.mo/teaching_learning/en/assessment_strategy.php). Passing this learning module indicates that students will have attained the ILOs of this learning module and thus acquired its credits.

Students with an overall score of less than 35 in the coursework must take the re-sit examination even if the overall score for the module is 50 or above.

Students with a score of less than 35 in the final examination must take the re-sit examination even if the overall score for the module is 50 or above.

Students with an overall final grade of less than 35 are NOT allowed to take the re-sit examination.

REQUIRED READINGS

There is no official text for this module. Course notes are distributed online or in the class.

REFERENCES

1. Shai Shalev-Shwartz and Shai Ben-David (2014). *Understanding Machine Learning: From Theory to Algorithms.* Cambridge University Press.

2. Ian Goodfellow, Yoshua Bengio and Aaron Courville (2016). *Deep Learning.* An MIT Press book, http://www.deeplearningbook.org.

STUDENT FEEDBACK

At the end of every semester, students are invited to provide feedback on the learning module and the teaching arrangement through questionnaires. Your feedback is valuable for instructors to enhance the module and its delivery for future students. The instructor and programme coordinators will consider all feedback and respond with actions formally in the annual programme review.

ACADEMIC INTEGRITY

The Macao Polytechnic University requires students to have full commitment to academic integrity when engaging in research and academic activities. Violations of academic integrity, which include but are not limited to plagiarism, collusion, fabrication or falsification, repeated use of assignments and cheating in examinations, are considered as serious academic offenses and may lead to disciplinary actions. Students should read the relevant regulations and guidelines in the Student Handbook which is distributed upon the admission into the University, a copy of which can also be found at www.mpu.edu.mo/student_handbook/.